

DETAILED ACTION

Oath/Declaration

The oath/declaration does not correctly identify the date of filing of the PCT application no. PCT/JP05/01003, for which the date of filing is shown as August 16 2006, as against Jan 26, 2005 indicated in USPTO records. A new oath, declaration or application data sheet is required in the body of which the filing date of the PCT application should be correctly identified.

Drawings

The drawings are objected to because several drawings include Japanese text without corresponding English translation, as per sample illustrations give hereunder.

1) In Figure 1 – cooling water is circulated inside central conductor 40 and inside electrode 20 (as per specification in paragraph 0031, lines 2-3), for which some Japanese text is indicated in Figure 1, without its English translation;

2) In Figure 3 – For the right side ordinate a Japanese text is indicated, without any English translation.

Applicant is requested to please check all the drawings and provide English translation alongside Japanese text, wherever it is presently missing.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must

be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spence et al (US 6,204,606).

Regarding Claim 1: Spence et al teach a plasma generation apparatus comprising:
an electrode 2 (conductive wall of waveguide 2 made from metal) composed of a conductor forming a minute gap 3 which allows a gas generating plasma (formed by microwaves and gas supplied through gas inlets 8) to pass there-through wherein an insulating film (dielectric coating formed on edge 15 of gap 3) is formed on a surface of at least a portion of the electrode, which forms the minute gap. Spence et al also teach that for a given input power, microwave discharges operating in gigahertz frequency range are capable of generating higher density of electrons-ion pairs and excited species than low frequency RF discharge operating in megahertz range, and also teach that the apparatus of the invention enables to obtain a high power density microwave discharge. It would be obvious to obtain increased electron density of guided microwave in the region of the gap (e.g. Figs. 1, 2 and col. 1, line 33-44 and col. 4, line 55 to col. 8, line 30).

Claims 1-4, 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (US 4,933,650) in view of Eguchi et al (US 2005/0208215).

Regarding Claim 1: Okamoto teaches a plasma generation apparatus comprising:
an electrode 51 (composed of copper) forming a minute gap d which allows a gas generating plasma (formed by microwaves supplied through waveguide 50, and gas supplied through gas inlet 501) to pass there-through. Okamoto also teaches that the apparatus enables efficient production and extraction of a stable and high density plasma from low pressure to

atmospheric pressure (e.g. Fig. 5 and col. 5, line 20 to col. 6, line 43) {claim limitation “electrode composed of conductor” has been interpreted to imply the central conductor 40, in applicant’s Figure 1. Applicant may please indicate if he has a different interpretation and amend the claim}. Though Okamoto does not explicitly teach the apparatus increases an electron density of a guided microwave, the same would be obvious since the apparatus enables to efficiently produce a high density plasma in the gap d.

Okamoto does not teach an insulating film is formed on a surface of at least a portion of the electrode, which forms the minute gap.

However use of an insulating film on the surface of an electrode is known in the art to avoid generation of arc discharge, as per reference cited hereunder.

Eguchi et al teach a plasma apparatus wherein a dielectric (insulating) layer is provided between electrodes 11, 12 (Figure 17) to prevent arc discharge (para. 0066, 0250). It would have been obvious to one of ordinary skills in the art at the time of the invention to form an insulating film on a surface of at least a portion of the electrode which forms the gap, in view of teaching of Eguchi et al to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to form an insulating film on a surface of at least a portion of the electrode as taught by Eguchi et al in the apparatus of Okamoto to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

Regarding Claim 2: Okamoto teaches a casing 50, 52 composed of a conductor into which microwave is introduced, and a bottom plate 70 composed of a metal (conductor) which

covers the end of casing (i.e. performs electromagnetic shielding at an end face of the casing 52 opposite to that at which microwave is introduced, wherein minute gap is formed in the bottom plate 70 (e.g. Figure 5 and col. 5, line 20 to col. 6, line 43) {claim limitation “bottom electrode” has been interpreted to imply the electrode 20, in applicant’s Figure 1. Applicant may please indicate if he has a different interpretation and amend the claim}.

Regarding Claims 3, 11: Okamoto in view of Eguchi et al teach all limitations of the claim (as already explained above under claims 1, 2) and further teach that the bottom plate 70 is provided with an opening 72 (window), and the electrode 51 is disposed at the bottom plate 70 so as to close the window, whereby the minute gap d is formed (Figure 5).

Regarding Claims 4, 12, 13: Okamoto teaches the electrode 51 has a structure in which the electrode 51 including a portion forming the minute gap d is cooled from the inside of the electrode by air (a cooling medium) supplied through coolant entrance 511 (Fig. 5 and col. 5, lines 46-68).

Regarding Claim 8: Okamoto teaches that coolant (cool air) supplied through coolant entrance cools metal plate 70 (i.e. bottom surface of the casing 52) {Fig. 5 and col. 5, lines 47-67}.

Regarding Claim 9: Okamoto teaches that microwaves can be applied in the form of pulses through a pulse power supply 10 (Figure 2) to generate a pulse plasma (col. 3, lines 55-65 and col. 6, lines 26-30).

Regarding Claim 10: Claim limitation pertaining to use of argon or nitrogen for plasma generation is related to contents of an apparatus during an intended use, and is not considered to be patentably significant.

Further, it has been held that:

“Expressions relating the apparatus to contents thereof during an intended operation are of no significance in determining patentability of the apparatus claim.” Ex parte Thibault, 164 USPQ 666, 667 (Bd. App. 1969).

Claims 5, 6 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (US 4,933,650) in view of Eguchi et al (US 2005/0208215).

Regarding Claim 5: Okamoto teaches a plasma generation apparatus comprising:
a tubular casing 52 with a bottom plate 70 into which a gas and a microwave are introduced;

an opening (hole) provided in a bottom surface of the casing (in metal plate 70);
a columnar conductor 51 provided in an axis direction of the casing 52 and having a bottom surface contour (annular shaped) inside a contour of the opening (hole in metal plate 70 at the bottom of the casing 52);

a minute gap d formed between the contour of the bottom surface of the conductor 51 and the contour of the hole (opening at the bottom of the casing 52 in the metal plate 70);

a coaxial waveguide 50 formed by the conductor 51 and the casing 52; and

wherein the microwave is introduced into the minute gap d by the coaxial waveguide 50, and the gas (supplied from gas inlet 501) is allowed to pass through the minute gap d, whereby the gas is placed in a plasma state at the minute gap (e.g. Fig. 5 and col. 5, line 20 to col. 6, line 43).

Okamoto does not teach an insulating film is formed at least on a contour portion forming the hole which forms the minute gap.

However use of an insulating film on the surface of an electrode is known in the art to avoid generation of arc discharge, as per reference cited hereunder.

Eguchi et al teach a plasma apparatus wherein a dielectric (insulating) layer is provided between electrodes 11, 12 (Figure 17) to prevent arc discharge (para. 0066, 0250). It would have been obvious to one of ordinary skills in the art at the time of the invention to form an insulating film at least on a contour portion forming the hole which forms the minute gap, in view of teaching of Eguchi et al to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to form an insulating film on a surface of at least a portion of the electrode as taught by Eguchi et al in the apparatus of Okamoto to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

Regarding Claim 6: Eguchi et al teach a plasma apparatus wherein a dielectric (insulating) layer is provided between electrodes 11, 12 (Figure 17) to prevent arc discharge (para. 0066, 0250). It would have been obvious to provide which is formed at least on a portion of conductor 51 which forms the minute gap d to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

Regarding Claim 19: Okamoto teaches that coolant (cool air) supplied through coolant entrance cools metal plate 70 (i.e. bottom surface of the casing 52) {Fig. 5 and col. 5, lines 47-67}.

Claims 7, 14-18, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (US 4,933,650) in view of Eguchi et al (US 2005/0208215) as applied to claims 1-6, 8-13, 19 and further in view of Besen et al (US 5,501,740).

Regarding Claims 7, 14-18: Okamoto in view of Eguchi et al teach all limitations of the claim including that bottom surface of conductor 51 is cooled by coolant supplied through coolant entrance 511, but do not explicitly teach that bottom surface of the conductor is cooled from the inside thereof.

Besen et al teach a microwave plasma apparatus comprising an electrode 114a whose bottom surface is cooled by supplying cooling water through gap 172 to enable maintain the electrode temperature and thus maintain substrate temperature more precisely during plasma generation and processing (e.g. Figs. 3, 4A and col.7, lines 40-65).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to cool the electrode by supplying coolant inside the electrode as taught by Besen et al in the apparatus of Okamoto in view of Eguchi et al to enable maintain the electrode temperature and thus maintain substrate temperature more precisely during plasma generation and processing.

Regarding Claim 20: Okamoto teaches that coolant (cool air) supplied through coolant entrance cools metal plate 70 (i.e. bottom surface of the casing 52) {Fig. 5 and col. 5, lines 47-67}.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claim 1 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 10, 11 of copending Application No. 12/242,025 (US PG PUB 2009/0223929) in view of Eguchi et al (US 2005/0208215).

Claims 10, 11 of the copending application teaches all limitations of the claim including an electrode that can form a minute gap for a microwave plasma to pass there-through and that apparatus increases electron density of the microwave.

Claims 10, 11 of the copending application do not teach an insulating film is formed at least on a contour portion forming the hole which forms the minute gap.

However use of an insulating film on the surface of an electrode is known in the art to avoid generation of arc discharge, as per reference cited hereunder.

Eguchi et al teach a plasma apparatus wherein a dielectric (insulating) layer is provided between electrodes 11, 12 (Figure 17) to prevent arc discharge (para. 0066, 0250). It would have been obvious to one of ordinary skills in the art at the time of the invention to form an insulating film on at least portion of the electrode in view of teaching of Eguchi et al to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to form an insulating film on a surface of at least a portion of the electrode as taught by Eguchi et al in the apparatus of claims 10, 11 of the copending application to avoid formation of arc discharge and obtain efficient transfer of electromagnetic energy to the plasma.

This is a provisional obviousness-type double patenting rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. D./
Examiner, Art Unit 1716

/Karla Moore/
Primary Examiner, Art Unit 1716